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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

KAO, CHIH CHENG G

ART UNIT	PAPER NUMBER
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2882

DATE MAILED: 04/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/769,490

Applicant(s)

ITOGA ET AL.

Examiner

Chih-Cheng Glen Kao

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4,11,12,24,25,27,34,35,39,40,42 and 46-53 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,11,12,24,25,27,34,35,39,40,42 and 46-53 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 January 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informality: page 83, line 28, "07". This objection may be obviated by replacing "07" with - 0.7- . Appropriate correction is required.

Claim Objections

2. Claims 1, 4, 11, 24, 27, 34, 35, 40, 42, 46, 47, and 50-53 are objected to because of the following informalities, which appear to be minor draft errors creating issues including grammatical and lack of antecedent basis problems.

In the following format (location of objection; suggestion for correction), the following suggestions may obviate their respective objections: (claim 1, line 7, "wherein the first angle"; replacing "first" with - second-), (claim 1, line 7, "greater than the second angle"; replacing "second" with - first-), (claim 4, line 3, "rhodium and palladium"; inserting a comma after "rhodium"), (claim 4, line 3, "carbides and borides"; inserting a comma after "carbides"), (claim 4, line 4, "carbon and boron nitride"; inserting a comma after "carbon"), (claim 11, line 5, "boron nitride and beryllium"; inserting a comma after "nitride"), (claim 24, line 7, "wherein the first angle"; replacing "first" with - second-), (claim 24, line 7, "greater than the second angle,"; replacing "second" with - first-), (claim 27, line 3, "rhodium and palladium"; inserting a comma after "rhodium"), (claim 27, line 3, "carbides and borides"; inserting a comma after "carbides"), (claim 27, line 4, "carbon and boron nitride"; inserting a comma after "carbon"),

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(claim 34, line 1, "claim 24 employing"; inserting - , further- - after "24"), (claim 34, line 5, "boron nitride and beryllium"; inserting a comma after "nitride"), (claim 35, line 1, "claim 24 employing"; inserting - , further- - after "24"), (claim 40, line 8, "wherein the first angle"; replacing "first" with - -second- -), (claim 40, line 8, "greater than the second angle"; replacing "second" with - -first- -), (claim 42, line 12, "wherein the first angle"; replacing "first" with - -second- -), (claim 42, line 12, "greater than the second angle"; replacing "second" with - -first- -), (claim 46, line 2, "means altering"; inserting - -for- - after "means"), (claim 46, line 2, "'said light"; replacing "light" with - -X-rays- -), (claim 47, line 2, "means altering"; inserting - -for- - after "means"), (claim 47, line 2, "said light"; replacing "light" with - -X-rays- -), (claim 50, line 6, "L represents"; replacing "L" with - -L α - -), (claim 50, line 11; replacing both instances of "L" with - -L α - -), (claim 51, line 12, "D represents"; replacing "D" with - -D α - -), (claim 51, line 14, replacing both instances of "D" with - -D α - -), (claim 52, line 7, "third and fourth"; inserting a comma after "third"), (claim 52, line 11, in the phrase "D represents"; replacing "D" with - -D α - -), (claim 52, line 13, " α and L"; replacing "L" with - -D α - -), (claim 52, line 13, "a relationship D"; replacing "D" with - -D α - -), and (claim 53, line 18, " $\tan(B-\alpha)$ "; replacing " $\tan(B-\alpha)$ " with - $\tan 2(B-\alpha)$ - -).

For purposes of examination, the claims have been treated as such. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it

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pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 39 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 39 recites a semiconductor device. However, since there is no direct relationship between the recited method and the physical structure of the device itself, the device as claimed does not impart any structure.

4. Claims 50-52 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are the x-axis and the direction of the distance between X-ray mirrors corresponding to a y-axis in a direction perpendicular to said x-axis.

This relationship is considered essential, since the cooperative relationship of the distances between X-ray mirrors and the x-axis in a coordinate system is necessary to ascertain how the change in angles and distances are satisfied in each respective trigonometric relationship. It is indefinite as to which particular distance between the X-ray mirrors is changed.

5. Claims 50-53 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted

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structural cooperative relationships are the X-rays mirrors and the optical axes of X-rays having substantially identical directions.

This relationship is considered essential, since the cooperative relationship of the X-ray mirrors and the X-rays having substantially identical directions is needed to determine how the change in angles and distances of the mirrors are satisfied in each respective trigonometric relationship while maintaining the substantially identical optical axes of X-rays. It is indefinite as to which X-rays have substantially identical optical axes during changes to the X-ray mirrors.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claim 39 is rejected under 35 U.S.C. 102(b) as being anticipated by Watanabe (JP 10-083955).

Watanabe discloses a semiconductor device (Paragraph [0079]). The method of forming a device is not germane to the issue of patentability of the device itself. Therefore, this limitation has not been given patentable weight.

7. Claim 50 is rejected under 35 U.S.C. 102(b) as being anticipated by Koiike (US Patent 5528364).

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Koike discloses an apparatus (Fig. 3) comprising a first stage X-ray mirror (Fig. 3, "PM") and a second stage X-ray mirror (Fig. 3, "G") that can satisfy a relationship $D = L\alpha \times \tan(2\alpha)$, whereby respective optical axes of X-rays incident and outgoing have substantially identical directions and spectral distribution of X-rays from the second stage is changed (Fig. 3, #5' and rotation of "PM" and "G").

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1, 2, 4, 24, 25, 27, 40, and 42 are rejected under 35 U.S.C. 103(a) as obvious over Watanabe in view of Cash, Jr. (US Patent 6049588).

9. With regards to claims 1, 4, 24, and 27, Watanabe discloses an x-ray exposure apparatus and method (Title) comprising: two x-ray mirrors receiving X-rays having an angle of oblique incidence of no more than 1.5° , wherein X-rays outputted from the first and second mirrors have one angle greater than the other (Paragraph [0034] and Fig. 11, #115), a first mirror collects X-rays (Fig. 11, #113), and the second mirror increases an area of a region illuminable by X-rays (Fig. 11, #115).

However, Watanabe does not specifically disclose a mirror material, such as beryllium, having an absorption edge only in a wavelength region other than 0.45 nm through 0.7 nm.

Cash, Jr. teaches a mirror material, such as beryllium, which would necessarily have an absorption edge only in a wavelength region other than 0.45 nm through 0.7 nm (col. 5, lines 37-38), since these are characteristics of beryllium.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the method and apparatus of Watanabe with the mirror material of Cash, Jr., since one would be motivated to incorporate this for higher reflection efficiency at low grazing angles (col. 5, lines 43-51) as shown by Cash, Jr.

10. With regards to claims 2, 25, 40, and 42, Watanabe further discloses an x-ray incidence step using a synchrotron radiation source (Abstract, "SR light").

11. Claims 11, 12, 34, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of Cash, Jr. as applied to claims 1 and 24 above, and further in view of Rostoker et al. (US Patent 5374974).

Watanabe in view of Cash, Jr. suggests a device and method as recited above.

However, Watanabe does not specifically disclose an x-ray mask comprising a membrane of beryllium having an absorption edge only in either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to x-rays, and an absorber having an absorption edge in a wavelength region of at least 0.6 nm and less than 0.85 nm.

Rostoker et al. teaches an x-ray mask comprising a membrane of beryllium (col. 4, lines 65-69), which would necessarily have an absorption edge only in a wavelength region other than 0.45 nm through 0.7 nm as a characteristic of beryllium, and an absorber with a material such as

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tungsten, (col. 5, lines 4-10), which would necessarily have an absorption edge in a wavelength region of at least 0.6 nm and less than 0.85 nm as a characteristic of tungsten.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the device and method of Watanabe in view of Cash, Jr. with the mask of Rostoker et al., since it would have only involved routine skill and experimentation to discover the optimum or workable ranges of a mask in combination with a mirror for an x-ray exposure apparatus. One would be motivated to combine the mask with the mirror to insure that the intended wavelengths, which are reflected from the mirror, pass through the mask to reach the sample, while unwanted wavelength regions are absorbed by the mask. One would also be motivated to use the mask of Rostoker et al. for its good transparency and absorbance as implied from Rostoker et al. (col. 10, lines 12-69 to col. 11, lines 1-40).

12. Claims 46-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of Cash, Jr. as applied to claims 1 and 24 above and further in view of Itabashi (JP 11-014800) and Hasegawa (JP 11-084098).

Watanabe in view of Cash, Jr. suggests an apparatus and method as described above.

However, Watanabe does not seem to disclose altering a peak wavelength and maintaining a direction or optical axis.

Itabashi teaches altering a peak wavelength (Figures 2 and 3). Hasegawa teaches maintaining a direction or optical axis (Abstract, Solution).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the device and method of Watanabe in view of Cash, Jr. with the

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alteration of a peak wavelength of Itabashi, since one would be motivated to incorporate this to better find the maximum intensity of x-rays reflecting off a mirror for the most efficient exposure (Figs. 2 and 3) as implied from Itabashi.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the device and method of Watanabe in view of Cash, Jr. with maintaining the optical axis or direction of Hasegawa, since one would be motivated to incorporate this to supply x-rays with a uniform high intensity distribution as implied from Hasegawa (Abstract).

Allowable Subject Matter

13. Claims 51-53 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action.

The following is an examiner's statement of reasons for allowability:

Regarding claims 51 and 52, prior art does not disclose or fairly suggest an x-ray apparatus satisfying a relationship $D\alpha = L \times \tan(2\alpha)$, in combination with all the limitations in each respective claim.

Regarding claim 53, prior art does not disclose or fairly suggest an x-ray apparatus satisfying a relationship $D = 2 \times L\alpha \times \tan(2\alpha) = L\beta \times \tan(\beta - \alpha)$, in combination with all the limitations in the claim.

Response to Arguments

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14. Applicant's arguments with respect to claims 1, 2, 4, 11, 12, 24, 25, 27, 34, 35, 39, 40, 42, and 46-50 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Bearden et al. (Reviews of Modern Physics) discloses the absorption edges of various materials.

US Patent 5949844, JP 11-003858, JP 11-026350, JP 11-038193, and JP 10-289867 disclose a first mirror collecting X-rays and a second X-ray mirror increasing an area of a region illuminable by X-rays outgoing from the X-ray mirrors.

US Patent Application Publication 20020048341 discloses an X-ray mirror containing a material having an absorption edge in at least one of a wavelength range of less than 0.45 nm and a wavelength range exceeding 0.7 nm.

US Patent Application Publications 20020196896 and 20030152190 disclose first, second, and third X-ray mirrors.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chih-Cheng Glen Kao whose telephone number is (571) 272-2492. The examiner can normally be reached on M - F (9 am to 5 pm).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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